



Reflective rooftops mitigate global warming

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By: Belle Dume

Researchers at the Lawrence Berkeley National Laboratory and the California Energy Commission, US, have proposed a simple way to counteract climate change - by increasing urban albedo. Replacing dark roofs and pavements with lighter-coloured ones around the world could offset around 44 Gt of carbon dioxide emissions, say Hashem Akbari and colleagues. At European trading levels of \$25/tonne of carbon dioxide, this would be worth about \$1.1 trillion.

Urban areas make up around 1% of the Earth's total land area, a figure that is likely to rise in coming years. Increasing the amount of sunlight reflected by urban surfaces, such as roofs and pavements (which make up over 60% of surfaces found in cities), reduces the amount of heat absorbed and so lowers their temperature. In turn, this reduces the amount of heat radiation emitted into the atmosphere, effectively counteracting global warming.

Akbari and colleagues have now calculated the equivalent reduction in carbon dioxide emissions when the solar reflectance of urban surfaces is increased.

Most existing flat roofs are dark and reflect only 10 to 20% of the sunlight falling on them. Replacing a typical 100 m² roof with a lighter-coloured material that reflects 40% or more of the incoming sunlight would offset 10 tonnes of carbon-dioxide emissions, say the researchers. Since carbon dioxide is currently traded at \$25/tonne in Europe, this one roof would be worth \$250.

Entirely replacing urban roofs and pavements in tropical and temperate regions with more reflective materials would offset 44 billion tonnes of emitted carbon dioxide, worth around \$1.1 trillion at \$25/tonne, according to the team.

"Assuming a plausible growth rate of 1.5% in the world's CO₂-equivalent emission rate, we estimate that the 44 Gt CO₂-equivalent offset potential for



cool roofs and pavements would counteract the effect of the growth in CO₂-equivalent emission rates for 11 years," say the researchers.

Estimated potential savings for white roofs in the US alone are worth more than \$1 billion a year in net annual energy bills. Cool roofs also reduce summertime temperatures in the city, leading to improved air quality in urban areas and fewer localized heat islands.

As a result of their work, Akbari and colleagues propose an international campaign to employ solar-reflective materials on newly built or resurfaced roofs and pavements in tropical and temperate regions. The "cool cities" programme could be used as a model to organize global efforts to lessen the effects of climate change, say the researchers. Installing cool roofs and pavements would not require international negotiations about capping carbon-dioxide-emission rates.

The researchers do stress, however, that their estimates are preliminary and that converting to cooler urban surfaces does not address the underlying problem of global warming, which results from greenhouse gas emissions and sunlight-absorbing particles.

The work was published in *Climatic Change*.